DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 2, 4-12 and 14-17 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 14 is indefinite because it does not recite a forge welding step in the body of the claim. It is unclear if this method is intended for a forge welding operation. For purposes of examination, the claim will be interpreted as if it is meant for a forge welding operation. It is suggested that Applicant amend the claim to recite a forge welding step in the body of the claim.

Claim Rejections - 35 USC § 102

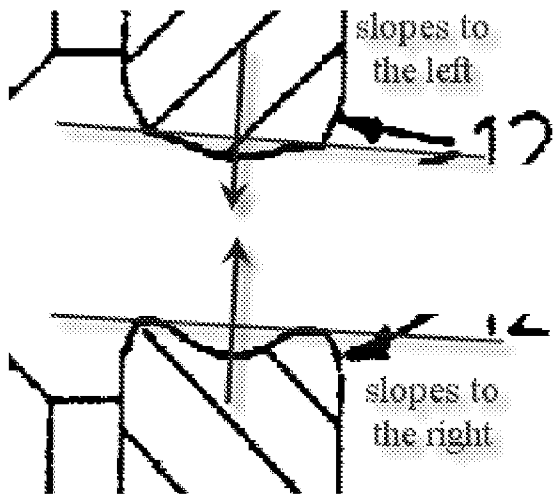
3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. **Claims 14, 16 and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by US 5,721,413 Moe**.

Regarding claim 14, Moe '413 teaches a method for interconnecting a first tubular **1** having a wall and a first end **3** with a second tubular **2** having a second end **4** by forge welding (column 1, lines 5-8), the method comprising forming the first end to include a first end face that is defined by a wall thickness of the tubular, the first end face having an annular convex shape,

forming the second end to include a second end face having an annular concave shape that is complementary to said convex shape (figure 3), wherein the concave shape has a sloping configuration such that a first central axis of the concave shape is angled toward a longitudinal axis of its respective tubular (see portion of figure 3 below), positioning the first end to be proximate to and in axial alignment with the second end (figure 3), heating the first and second ends such that the heated first and second ends deform due to thermal expansion (column 2, lines 8-12), the first central axis of the concave shape having the sloping configuration substantially aligning with a second central axis of the convex shape and such that the convex shape may be pressed into the concave shape (figure 3) and pressing the convex shape into the concave shape to join the first and second ends. Moe '413 does not explicitly teach the pressing step. However, this must occur in the forge welding method in order to join the two tubulars together.



Portion of figure 3 from Moe '413

Regarding the first central axis angled toward a longitudinal axis, please note the following: While Moe '413 teaches this, several alternate interpretations could have been taken. 1) If the convex or concave shape ran parallel to the walls of the tubulars, one could take the position that the first central axis is angled toward a longitudinal axis by 0° or 2) if the convex or concave shape angled away from the center of the tubular, one could take the position that the first central axis is still angled toward ***a*** longitudinal axis. Because the claim does not limit the

longitudinal axis to the ***central*** longitudinal axis, any axis that runs in the direction of the length of the tubular is a longitudinal axis, including axes that are located outside of the tubular. Thus, any direction that the first central axis is angled toward will be angled toward a longitudinal axis.

Regarding claim 16, Moe '413 teaches that the first central axis is angled toward the longitudinal axis by approximately one degree to approximately five degrees (see portion of figure 3 above).

Regarding claim 17, Moe '413 teaches forming both the concave and convex shapes such that each of them has a respective axis that is angled toward a longitudinal axis of its respective tubular. Because the claim does not limit the longitudinal axis to be the ***central*** longitudinal axis, any axis that runs in the direction of the length of the tubular is a longitudinal axis, including axes that are located outside of the tubular. Thus, any direction that the first central axis is angled toward will be angled toward a longitudinal axis (figure 3).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 15, 2, 4 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,721,413 Moe in view of US 4,669,650 Moe.

Regarding claim 15, Moe '413 teaches a method of forge welding two tubulars by resistance heating and then pressing the end faces together. Moe '413 does not teach the ratio between D(t) and D(b). Moe '650 teaches a method of forge welding two tubulars by heating

with an induction coil and pressing the two end faces together, further comprising the step of selecting the sloping configuration being selected such that the ratio between an average diameter D(t) of a tip of the convex shape and an average diameter D(b) of the tubular wall is related to an estimated temperature difference between the tip and tubular wall and a thermal expansion co-efficient of the tubular end (column 3, lines 11-15 and 24-36).

Regarding claim 2, Moe ‘413 further teaches D(t) as just smaller than D(b) (see page 3 of the previous Office Action mailed July 22, 2009), but does not teach the exact ratio. However, it would have been obvious to one of ordinary skill in the art at the time of the invention to determine the optimum ratio of D(t)/D(b). “[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation,” (MPEP 2144.05 Section II).

Regarding claim 4, Moe ‘650 teaches machining the tubular ends to reduce a wall thickness in a welding zone (column 3, lines 24-25).

Regarding claim 6, Moe ‘413 teaches a method of forge welding two tubulars by resistance heating and then pressing the end faces together. Moe ‘413 does not teach shapes. Moe ‘650 teaches that the convex shape is wedge shaped (figure 1). It would have been obvious to include the configuration of Moe ‘650 in the method of Moe ‘413 because this configuration allows the application of pressure during the welding step without creating wider pipe walls.

7. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,721,413 Moe in view of JP 03-243286 Masakatsu et al.

Regarding claim 5, Moe ‘413 teaches a method of forge welding two tubulars by resistance heating and then pressing the end faces together. Moe ‘413 does not teach the

composition of the pipes or the cladding. Masakatsu teaches a method for joining clad tubes where the tubulars comprising a relatively lower grade steel base pipe and a higher grade steel cladding on an inner and/or outer surface of the base pipe and the first and second end faces are shaped such that when the tubular ends are pressed together the end faces of the cladding(s) touch each other before the end faces of the base pipe ends touch (p.2 line 46-page 3, line 1 and figure 2). It would have been obvious to include the composition and configuration of Masakatsu in the method of Moe because this cladding and configuration protects the pipes from final machining during the welding and polishing process.

8. Claims 7, 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,721,413 Moe in view of JP 03-243286 Masakatsu et al as applied to claim 5 above, and further in view of US 4,669,650 Moe.

Regarding claim 7, Moe ‘413 teaches a method of forge welding two tubulars by resistance heating and then pressing the end faces together. Moe ‘413 does not teach the cladding or machining. Masakatsu teaches a method for joining clad tubes where the adjacent end portions of the adjacent base pipes are covered with the clad metal (figure 2). Moe ‘650 teaches machining at least one of the first and second ends (column 3, lines 24-25), capable of allowing machining of said end portions without exposing the base pipes. It would have been obvious to include the cladding of Masakatsu and the machining of Moe ‘650 in the method of Moe ‘413 because this cladding and machining allows one to create the desired final wall thickness without damaging the base pipe.

Regarding claim 8, Moe ‘413 teaches a method of forge welding two tubulars by resistance heating and then pressing the end faces together. Masakatsu teaches claddings. Neither

Moe '413 nor Masakatsu teaches a flushing gas. Moe '650 teaches flushing a welding zone with a flushing gas injected into the welding zone from an uncladded side of the tubular, such that the flushing gas continues to reach the ends of the still spaced base pipes after the claddings have touched (column 2, lines 56-65). It would have been obvious to one of ordinary skill in the art at the time of the invention to include the flushing gas of Moe '650 in the method of Moe '413 and Masakatsu because a flushing gas reduces the potential for oxides to form on the workpieces and therefore improves the quality of the weld.

Regarding claim 9, Moe '650 teaches the flushing gas as a reducing flushing gas (column 2, lines 65-67). It would have been obvious to one of ordinary skill in the art at the time of the invention to include the reducing gas of Moe '650 in the method of Moe '413 and Masakatsu because a reducing gas eliminates oxides from the working environment and therefore improves the quality of the weld.

9. Claims 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,721,413 Moe and JP 03-243286 Masakatsu et al in view of US 4,669,650 Moe as applied to claim 9 above, and further in view of US 3,941,299 Godfrey.

Regarding claims 10-12, Moe '413 teaches a method of forge welding two tubulars by resistance heating and then pressing the end faces together. Masakatsu teaches claddings. Moe '650 teaches a flushing gas. None of Moe '413, Masakatsu or Moe '650 teaches the composition of the flushing gas. Godfrey teaches a method of brazing metal pieces together where a non-explosive flushing gas mixture comprises more than 90% by volume of nitrogen and at least 2% by volume of hydrogen (column 2, lines 55-59). It would have been obvious to substitute welding for brazing because the substitution of one known element for another would have

yielded predictable results to one of ordinary skill in the art at the time of the invention. It would have been further obvious to include the flushing gas of Godfrey in the method of Moe, Moe and Masakatsu because a non-reactive flushing gas prevents oxidation during the welding process.

10. **Claims 14 -17, 2, 4 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 4,669,650 Moe in view of US 5,721,413 Moe**.

Regarding claim 14, Moe ‘650 teaches a method for interconnecting a first tubular **1** having a wall and a first end with a second tubular **2** having a second end **4** by forge welding (column 1, lines 5-7), the method comprising forming the first end to include a first end face that is defined by a wall thickness of the tubular, forming the second end to include a second end face (figure 1), wherein one tubular wall has a sloping configuration such that a first central axis is angled toward a longitudinal axis of its respective tubular (figure 1), positioning the first end to be proximate to and in axial alignment with the second end (figure 1), heating the first and second ends such that the heated first and second ends deform due to thermal expansion (column 1, lines 11-14), the first central axis having the sloping configuration substantially aligning with a second central axis (figure 1) and pressing the tubulars together to join the first and second ends (column 1, lines 15-16).

Moe '650 does not teach the concave and convex ends. Moe ‘413 teaches a method of forge welding two tubulars by resistance heating and then pressing the end faces together where one tubular end face has a concave shape and the other tubular end face has a convex shape (figure 3). It would have been obvious to include the concave and convex shapes of the end faces of '413 in the method of '650 because the concave and convex shapes help secure one piece to

another and reduce sliding and shifting of the pieces relative to each other during the welding process.

Regarding claim 15, Moe '650 teaches the step of selecting the sloping configuration being selected such that the ratio between an average diameter D(t) of a tip of the convex shape and an average diameter D(b) of the tubular wall is related to an estimated temperature difference between the tip and tubular wall and a thermal expansion co-efficient of the tubular end (column 3, lines 11-15 and 24-36).

Regarding claim 16, Moe '650 teaches that the first central axis is angled toward the longitudinal axis by approximately one degree to approximately five degrees (see portion of figure 1 below).

Regarding claim 17, Moe '650 in view of Moe '413 teaches forming both the concave and convex shapes such that each of them has a respective axis that is angled toward a longitudinal axis of its respective tubular (figure 1).

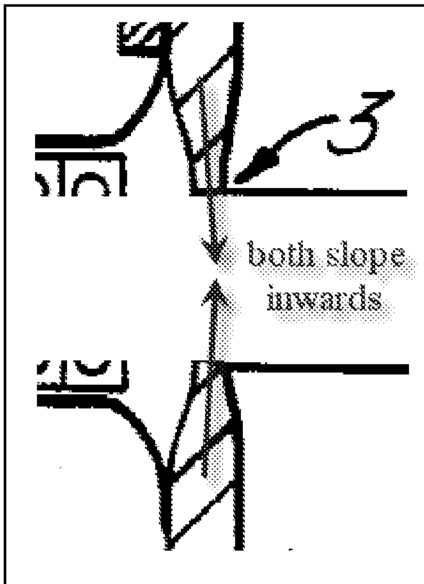


Figure 1 of Moe '650

Regarding claim 2, Moe '413 further teaches D(t) as just smaller than D(b) (see page 3 of the previous Office Action mailed July 22, 2009), but does not teach the exact ratio. However, it would have been obvious to one of ordinary skill in the art at the time of the invention to determine the optimum ratio of D(t)/D(b). "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation," (MPEP 2144.05 Section II).

Regarding claim 4, Moe ‘650 teaches machining the tubular ends to reduce a wall thickness in a welding zone (column 3, lines 24-25).

Regarding claim 6, Moe ‘650 teaches that the convex shape is wedge shaped (figure 1).

11. Claims 5, 7, 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 4,669,650 Moe in view of US 5,721,413 Moe as applied to claim 14 above, and further in view of JP 03-243286 Masakatsu et al.

Regarding claim 5, Moe ‘650 teaches a method of forge welding two tubulars by heating with an induction coil and pressing the two end faces together and machining. Moe ‘413 teaches convex and concave faces. Neither Moe ‘650 nor Moe ‘413 teaches the composition of the pipes or the cladding. Masakatsu teaches a method for joining clad tubes where the tubulars comprising a relatively lower grade steel base pipe and a higher grade steel cladding on an inner and/or outer surface of the base pipe and the first and second end faces are shaped such that when the tubular ends are pressed together the end faces of the cladding(s) touch each other before the end faces of the base pipe ends touch (p.2 line 46-page 3, line 1 and figure 2). It would have been obvious to include the composition and configuration of Masakatsu in the method of Moe because this cladding and configuration protects the pipes from final machining during the welding and polishing process.

Regarding claim 7, Moe ‘650 teaches a method of forge welding two tubulars by heating with an induction coil and pressing the two end faces together and machining at least one of the first and second ends (column 3, lines 24-25). Moe ‘413 teaches convex and concave faces. Neither Moe ‘650 nor Moe ‘413 teaches the cladding. Masakatsu teaches a method for joining clad tubes where the adjacent end portions of the adjacent base pipes are covered with the clad

metal (figure 2) such that the ends may be machined without exposing the base pipes. It would have been obvious to include the cladding of Masakatsu in the method of Moe because this cladding protects the pipes from final machining during the welding and polishing process.

Regarding claim 8, Moe ‘650 teaches flushing a welding zone with a flushing gas injected into the welding zone from an uncladded side of the tubular, such that the flushing gas continues to reach the ends of the still spaced base pipes after the claddings have touched (column 2, lines 56-65).

Regarding claim 9, Moe ‘650 teaches the flushing gas as a reducing flushing gas (column 2, lines 65-67).

12. Claims 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 4,669,650 Moe in view of US 5,721,413 Moe and further in view of JP 03-243286 Masakatsu et al as applied to claim 9 above, and further in view of US 3,941,299 Godfrey.

Regarding claims 10-12, Moe ‘650 teaches a method of forge welding two tubulars by heating with an induction coil and pressing the two end faces together and machining. Moe ‘413 teaches convex and concave faces. Masakatsu teaches claddings. None of Moe ‘650, Moe ‘413 or Masakatsu teaches the composition of the flushing gas. Godfrey teaches a method of brazing metal pieces together where a non-explosive flushing gas mixture comprises more than 90% by volume of nitrogen and at least 2% by volume of hydrogen (column 2, lines 55-59). It would have been obvious to substitute welding for brazing because the substitution of one known element for another would have yielded predictable results to one of ordinary skill in the art at the time of the invention. It would have been further obvious to include the flushing gas of

Godfrey in the method of Moe, Moe and Masakatsu because a non-reactive flushing gas prevents oxidation during the welding process.

Response to Arguments

13. Applicant's arguments filed January 22, 2010, have been fully considered but they are not persuasive.

Applicant argues that Moe ‘650 mechanically deforms the tubulars instead of thermally deforming. However, while pressure is used in the method, as the tubes are heated enough to soften and join the ends, thermal expansion is necessarily occurring in the process and is deforming the tubes as well.

Applicant argues that Moe ‘413 does not show that the central axes of the concave and convex shapes align with each other. However, as shown in the annotated portion of figure 3 above, the central axes come together and align where the end faces meet. Additionally, because the concave and convex shapes are complementary, the central axes must align and come together at the center.

Applicant finally argues that Godfrey teaches away from the reducing atmosphere. However, just because Godfrey calls his atmosphere “inert” does not make it entirely non-reactive. As required by the claim, Godfrey teaches 5-10% hydrogen gas in a nitrogen atmosphere. The hydrogen is a reactive, reducing gas and will reduce the surface of the objects to be joined.

Applicant argues that it would not have been obvious to substitute the welding process with a brazing process as the brazing process is unsuitable for the joining of tubulars. However, the Examiner never made this assertion. Instead, the Examiner only relied on Godfrey for

including the claimed atmosphere composition in the method of Moe, Moe and Masakatsu. The Examiner then explained how welding and brazing are similar processes which may use the same working atmosphere, as they are both processes used to join one metal object to another to create an assembly.

Conclusion

14. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MEGHA MEHTA whose telephone number is (571)270-3598. The examiner can normally be reached on Monday to Friday 7:30 am to 5:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jessica Ward can be reached on 571-272-1223. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Megha Mehta/
Examiner, Art Unit 1793

/Jessica L. Ward/
Supervisory Patent Examiner, Art Unit 1793